DESCRIPTION OF DIMORPHISM IN *STRIATOPORA FLEXUOSA* HALL

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ABSTRACT. *Striatopora* Hall comprises branching favositoid tabulate corals with thick, dilated walls near the outer surface of the colonies. Study of serial sections of the type species, *S. flexuosa* Hall, shows that individuals within colonies commonly originated in one of two positions, either near the axis of the colony or near the boundary between inner thin-walled and outer thick-walled zones. Corallites originating in the two positions are morphologically distinct and were produced alternately by corallites of the first type. Corallites of the second type did not reproduce asexually. Previous descriptions of *S. flexuosa* have been based on exteriors of colonies or on material other than the type specimens. Redescription of the type specimens based on thin section studies provides a better basis for understanding the genus.

Other named genera of morphologically comparable corals can be differentiated on the basis of wall microstructure or other features, or are possible subjective synonyms of *Striatopora*.

THE tabulate coral genus *Striatopora* Hall has been widely accepted since its first description in 1851, and specimens ranging in age from Silurian to Permian, from most continents, have been referred to it. Most workers have loosely conceived of the genus as a branching favositoid with a certain amount of wall dilation in individual corallites, especially near the surface of the colony. This concept was based on Hall's description and illustrations of the exterior of the Silurian type species, *S. flexuosa*. In recent years the accepted concept has been narrowed, good redescriptions of the type species have been published, and additional genera have been erected to include forms once referred to *Striatopora* sensu lato. Although the type species is now comparatively well known, much of the available descriptive information is based on specimens other than the syntypes, which have not previously been sectioned. The purpose of this paper is to describe the developmental pattern within colonies, to redescribe the type specimens so that there will be a satisfactory basis for understanding the genus, and to outline the problems connected with this and other morphologically similar genera.

Acknowledgements. The redescription was undertaken at the suggestion of Professor Dorothy Hill, Brisbane, Australia, who pointed out the need for a fuller understanding of *Striatopora flexuosa*. I am indebted to Professor Hill for her comments on an early draft of the description and generic discussion, many of which have been incorporated in the text. The manuscript also profited from review by Dr. Richard S. Boardman, U.S. National Museum, who suggested that the included analysis of colony growth be undertaken. The syntype collection is housed in the American Museum of Natural History (AMNH) and was loaned to me by Dr. Roger L. Batten. Topotype collections in the U.S. National Museum (USNM) were made available by Dr. Boardman. Photographs are by Robert H. McKinney (exteriors) and David H. Massie (thin sections). Publication is authorized by the Director, U.S. Geological Survey.

PATTERN OF GROWTH

After initial study of Hall's original specimens (see below), two topotype fragments of *S. flexuosa* were prepared by making two series of 8 and 10 thin sections, transverse to the branch axis at 1 mm. intervals. In these and other specimens, offsets (new corallites;

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'buds') were formed only in two positions, at the branch axis and near the boundary between the inner (thin-walled) and outer (thick-walled) zones.

Offsets originating at the branch axis (**a**-offsets in the following discussion) appear on the axial side of the thin-walled part of the protocorallite (**a** on Pl. 69, fig. 1, and Pl. 70, fig. 3). A polygonal bulge in the parental wall precedes the development of a new wall separating parent and **a**-offset (several examples can be seen in Pl. 71, figs. 1–6). Initially, **a**-offsets have thin walls with minimal light-coloured lamellar deposits.

Offsets appearing at the boundary between the inner and outer zones (**b**-offsets) also appear on the axial side of the protocorallite but seemingly form on the thick lamellar part of the parental wall (**b** on Pl. 69, fig. 1, and Pl. 70, fig. 3).

a- and **b**-corallites are morphologically distinct. Measured to the nearest millimetre, 14 **a**-corallites range in length from 5 to more than 9 mm., 6 mm. being the most common observed length; 15 **b**-corallites range from 2 to 4 mm. in length with 10 individuals being 3 mm. long. In addition, wall dilation is limited to the distal one-third to one-half of each **a**-corallite, whereas **b**-corallite walls are dilated along their entire length.

Within the studied material the pattern of colony development seems to be consistent. Each **a**-corallite gives rise to two offsets ('buds'). An **a**-offset is formed as the parent separates from the axis; a **b**-offset is formed as the parent becomes thick-walled. Both types are labelled in longitudinal sections illustrated on Plates 69 and 70. **b**-corallites do not produce offsets. The result of obtaining two offsets from each **a**-corallite and none from **b**-corallites is the **a**–**b** alternation which is so clearly shown in the illustrations. The lack of alternation at the top of the figured longitudinal sections is only apparent. Presumably each of the adjacent **a**-corallites produced **b**-corallites above the limits of the thin section.

If the described pattern of development were invariable, **a**- and **b**-offsets should appear in equal numbers. Counts were made in the two serial series with these results: in specimen USNM 146505 (Pl. 71, figs. 1–6), I identified 10 **a**-offsets and 10 **b**-offsets in the 5-mm. length illustrated; two other offsets are of uncertain origin. In the second specimen I found 8 **a**-, and 10 **b**-offsets in 5 mm. Although based on a small sample, these data do support the suggested alternation of **a**- and **b**-types. There are exceptions, however. On Plate 71, corallite 7 gives rise to **a**-offset 23 in fig. 4; 2 mm. higher in the branch (fig. 6), the same corallite gives rise to two more offsets which are completely separated from corallite 7 in a thin section taken 1 mm. higher. The upper offsets are probably **b**-types, although this is not certain from the section; neither is included in the previous offset count because no new wall was formed within the 5-mm. portion on which the count was based. Perhaps the 'extra' corallite was needed to fill space in the colony.

The dimorphism represented by **a**- and **b**-corallites was probably significant in the development of the living colony. **a**-polyps went through a longer development period. This may have been required for the attainment of full maturity, and **a**-polyps may have reproduced sexually as well as asexually. **b**-polyps apparently skipped early growth stages. They may have attained normal maturity for some functions, such as feeding or defence, but not for others, such as reproduction. Alternate production of **a**- and **b**-polyps permitted faster colony growth, which may have given the species certain advantages in food and/or oxygen intake or in some other way. Presumably both types of polyps competed for space with surrounding individuals but in somewhat different micro-environments.

The formation of **a**- and **b**-offsets is in some ways similar to lateral and peripheral offsetting, respectively, in rugose corals.

SYSTEMATIC DESCRIPTION

Genus STRIATOPORA Hall

Striatopora Hall 1851, p. 400; 1852, p. 156; Wells 1944, pp. 259–60 [part]; Hill and Stumm 1956, pp. 464 [part]; Lafuste 1959, pp. 85–87.

Type species. By monotypy, *S. flexuosa* Hall 1852, p. 156, pl. 40B, figs. 1*a–e*. Middle Silurian, Rochester Shale, Lockport, New York.

Diagnosis. Ramose favositoid coralla with cylindrical or slightly compressed branches. Corallites gently curve away from axial region, opening obliquely to surface on small branches, perpendicularly on large branches. Corallite walls thin axially, strongly dilated distally, distinctly lamellar. Corallites polygonal in cross-section, but lumen round because of dilation. Mural pores common. Septal spines project into lumen, expressed as septal ridges in calice. Tabulae complete.

Discussion. Several genera of ramose cerioid tabulates with greater or lesser dilation of distal corallite walls have been described, and it is not at all clear how they interrelate. Wells (1944) discussed the morphologic series *Favosites*→*Thamnopora*→*Striatopora*→*Trachypora* as one of increasing wall dilation with complete gradation in this character, but subsequent work indicates that the phylogenetic relationships are more complex than this would suggest. The genera were originally described without adequate analysis of similarities and differences and without knowledge of the morphology of even the type species of earlier genera. Some of these genera are briefly discussed below with emphasis on apparent differences from *Striatopora*.

Thamnopora Steininger (1833; see Lecompte 1939, pp. 102–4) has cylindrical or compressed branches; corallite walls are moderately dilated, the dilation increasing distally; septal spines are weak or lacking. Lecompte (1936, pp. 14–16), working with the Middle Devonian type material, and Lafuste (1958) have described the wall structure as fibrous, the fibres arranged more or less normal to the wall surface (radial-fibrous). Similar wall

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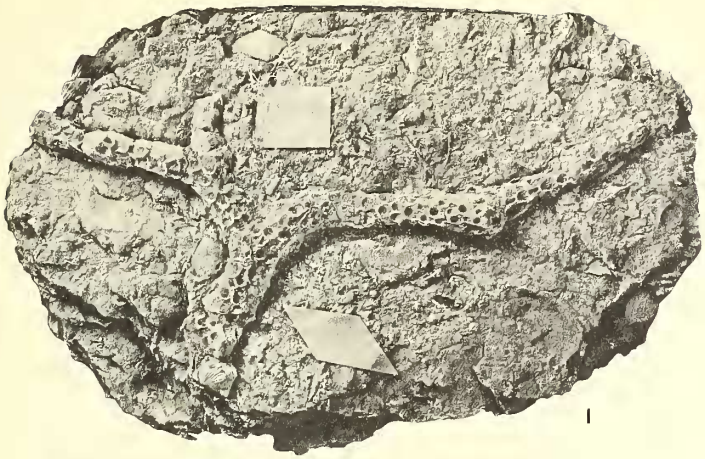
EXPLANATION OF PLATE 68

Figs. 1–7, *Striatopora flexuosa* Hall. 1–4, Lectotype corallum, AMNH 1685:1, the original of Hall 1852, pl. 40B, fig. 1*a*. 1, Exterior of complete specimen (×1), thin sections were taken from the distal end of the right-hand branch. 2, Enlargement of central portion of corallum (×2). 3–4, Longitudinal and transverse thin sections (×20), note the relatively thin walls in this 'young' portion of the colony. 5, Paralectotype, AMNH 1685:2; exterior (×2); the original of Hall 1852, pl. 40B, fig. 1*b*. 6, Paralectotype, AMNH 1685:6; exterior (×2); not illustrated by Hall; see also pl. 70, fig. 6. 7, Paralectotype, AMNH 1685:3; exterior (×2); note that septal ridges are especially well preserved on this specimen; original of Hall 1852, pl. 40B, fig. 1*c*.

EXPLANATION OF PLATE 69

Figs. 1–5, *Striatopora flexuosa* Hall. Paralectotype, AMNH 1685:4; not illustrated by Hall; see also Pl. 70. 1–2, Longitudinal thin section (×10) and detail of same (×50), note mural pores, septal spines and lamellar wall-structure; **a**- and **b**- corallites are so labelled. 3–4, Transverse thin section (×10) and detail of same (×50), note septal spines and lamellar wall-structure. 5, Another transverse thin section (×10), showing mural pores and excessive wall dilation.



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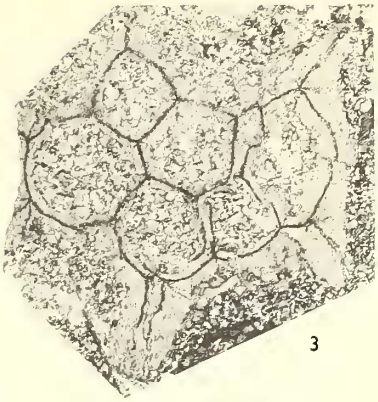

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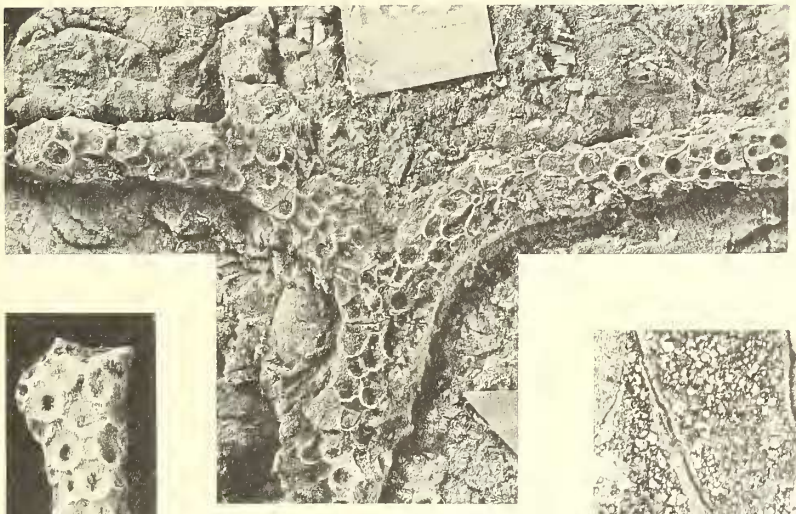

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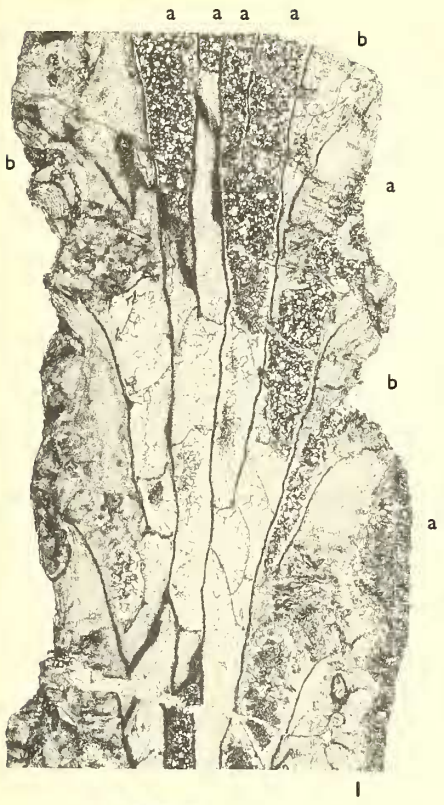
OLIVER, *Striatopora flexuosa* Hall



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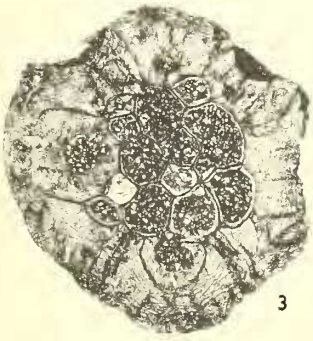

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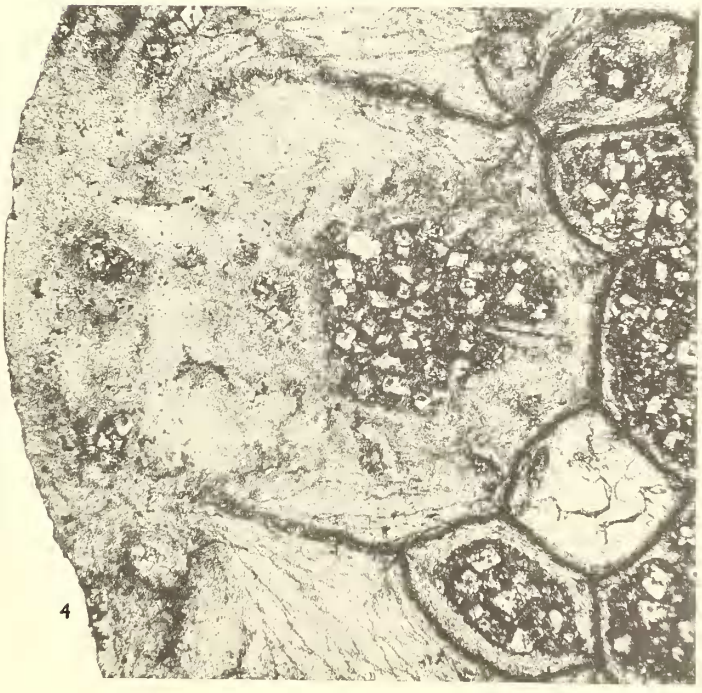

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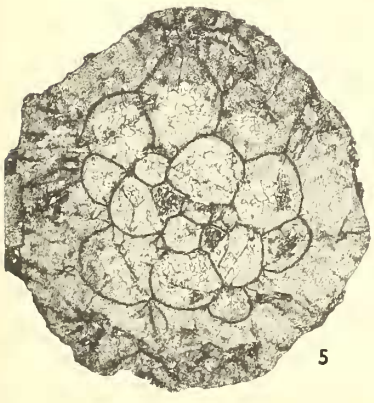

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OLIVER, *Striatopora flexuosa* Hall